

## CLAIMS

1    1. A method for extracting data of interest from observed vector data, the method  
2 comprising:

3                 determining the projection of each vector in observed vector data onto a subspace as a  
4 vector subtraction in an original coordinate system.

1    2. A method for processing a block of discrete data vectors to obtain a decomposition of the  
2 data with respect to a correlation direction vector, the method comprising:

3                 multiplying each data vector onto the correlation direction vector to determine a scalar  
4 amplitude of each data vector in the direction of the correlation direction vector;

5                 multiplying each scalar amplitude onto the correlation direction vector to determine a set  
6 of scaled vectors; and

7                 subtracting the scaled vectors from the data vectors.

1    3. In a filter, a method for processing a block of discrete data vectors to obtain a  
2 decomposition of the data with respect to a correlation direction vector, the method comprising:

3                 multiplying each data vector onto the correlation direction vector to determine a scalar  
4 amplitude of each data vector in the direction of the correlation direction vector;

5                 multiplying each scalar amplitude onto the correlation direction vector to determine a set  
6 of scaled vectors; and

7                 subtracting the scaled vectors from the data vectors.

1    4. A method for adaptively analyzing data, the data characterized by a set of data vectors, to  
2 estimate that part of the data that best corresponds to a steering vector, the method comprising:

3                 in a first analysis stage:

4                 projecting each data vector onto the steering vector to form a set of inner products  
5                 that estimate the part of the data that best corresponds to the steering vector,

6                 multiplying the inner products onto the steering vector to form a set of vector  
7                 estimates of that part of the data that best corresponds to the steering vector,

8                 subtracting the vector estimates from the corresponding data vectors to obtain a  
9                 projection of the data onto the nullspace of the steering vector; and

10       in at least one adaptive analysis stage:  
11           calculating a correlation direction vector of the current adaptive stage between the  
12           corresponding inner products and vector differences of an immediately prior  
13           analysis stage;  
14           forming inner products of the current stage by projecting each vector difference of  
15           the immediately prior analysis stage onto the correlation direction vector of the  
16           current stage;  
17           forming scaled vectors of the current stage by multiplying the inner products of the  
18           current stage onto the correlation direction vector of the current stage;  
19           forming the projection of the prior stage vector differences onto the nullspace of the  
20           correlation direction vector of the current stage by subtracting each scaled  
21           vector of the current stage from the corresponding projection of the prior stage.

1       5.     A method for adaptively analyzing an observed signal, the signal characterized by a set of  
2     data vectors, to estimate that part of the signal that best corresponds to a steering vector, the  
3     method comprising:  
4        in a first analysis stage:  
5           projecting each data vector onto the steering vector to form a set of inner products  
6           that estimate the part of the data that best corresponds to the steering vector,  
7           multiplying the inner products onto the steering vector to form a set of vector  
8           estimates of that part of the data that best corresponds to the steering vector,  
9           subtracting the vector estimates from the corresponding data vectors to obtain a  
10           projection of the data onto the nullspace of the steering vector; and  
11        in at least one adaptive analysis stage:  
12           calculating a correlation direction vector of the current adaptive stage between the  
13           corresponding inner products and vector differences of an immediately prior  
14           analysis stage;  
15           forming inner products of the current stage by projecting each vector difference of  
16           the immediately prior analysis stage onto the correlation direction vector of the  
17           current stage;  
18           forming scaled vectors of the current stage by multiplying the inner products of the  
19           current stage onto the correlation direction vector of the current stage;

20 forming the projection of the prior stage vector differences onto the nullspace of the  
21 correlation direction vector of the current stage by subtracting each scaled  
22 vector of the current stage from the corresponding projection of the prior stage.

23 6. A method for adaptively analyzing discrete data, the data characterized by a vector data  
24 set and a scalar data set, the sets having a common index, to obtain a decomposition of the data  
25 based on correlation between the sets, the method comprising

26 in a first stage:

27 forming a first stage correlation direction vector between corresponding elements of  
28 the vector data set and the scalar data set;

29 forming a set of first stage inner products between the vector data set and the first  
30 stage correlation direction vector;

31 forming a set of first stage scaled direction vectors between the scalar data set and  
32 the first stage correlation direction vector;

33 forming a set of first stage vector differences between the corresponding elements of  
34 the set of first stage scaled direction vectors and the vector data set; and

35 in each of zero or more subsequent stages:

36 receiving the set of inner products and the set of vector differences of the  
37 immediately prior stage as inputs to the current stage;

38 forming a current stage correlation direction vector between corresponding elements  
39 of the sets of inner product and vector difference current stage inputs;

40 forming a set of current stage inner products between the set of current stage vector  
41 difference inputs and the current stage correlation direction vector;

42 forming a set of current stage scaled direction vectors between the set of inner  
43 product current stage inputs and the current stage correlation direction vector;

44 forming a set of current stage vector differences between the corresponding elements  
45 of the set of current stage scaled direction vectors and the set of current stage  
46 vector difference inputs.

1 7. An analysis chain for a multistage adaptive filter, the analysis chain comprising:

2 a non-adaptive analysis stage, comprising:

3 a first inner product logic device operative:

4 to receive a set of data vectors and a steering vector, and

5 to form a first set of inner products of the steering vector and each data vector,  
6 and  
7 a first vector scaling logic device:  
8 in communication with the first inner product logic device, and  
9 operative:  
10 to receive the steering vector and the first set of inner products, and  
11 to form a first set of scaled direction vectors of the steering vector and  
12 each inner product of the first set of inner products, and  
13 a first vector difference logic device:  
14 in communication with the first vector scaling logic device, and  
15 operative:  
16 to receive the set of data vectors and the first set of scaled vectors, and  
17 to form a first set of vector differences between corresponding elements of  
18 the set of data vectors and the first set of scaled vectors; and  
19 at least one adaptive analysis stage comprising:  
20 a correlation direction vector logic device:  
21 in communication with the immediately prior stage, and  
22 operative:  
23 to receive a set of vector differences of the immediately prior stage and a  
24 set of inner products of the immediately prior stage, and  
25 to form a current stage correlation direction vector between the vector  
26 differences of the immediately prior stage and the corresponding  
27 inner products of the immediately prior stage; and  
28 an adaptive stage inner product logic device:  
29 in communication with the immediately prior stage and the adaptive stage  
30 correlation direction vector logic device of the current stage, and  
31 operative:  
32 to receive the set of vector differences of the immediately prior stage and  
33 the current stage correlation direction vector, and  
34 to form a current stage set of inner products of each vector difference of  
35 the immediately prior stage and the current stage correlation direction  
36 vector; and  
37 an adaptive stage vector scaling logic device:

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38                   in communication with the correlation direction vector logic device of the  
39                   current stage and the inner product device of the current stage, and  
40                   operative:

41                   to receive the set of inner products of the current stage and the correlation  
42                   direction vector of the current stage, and

43                   to form a current stage set of scaled direction vectors of each inner product  
44                   of the set of inner products of the current stage and the correlation  
45                   direction vector of the current stage; and

46                   an adaptive stage vector difference logic device:

47                   in communication with the vector difference logic device of the immediately  
48                   prior stage and the vector scaling logic device of the current stage, and

49                   operative:

50                   to receive the set of vector differences of the immediately prior stage and  
51                   the set of scaled vectors of the current stage, and

52                   to form a current stage set of vector differences between corresponding  
53                   elements of the set of vector differences of the immediately prior  
54                   stage and the set of scaled direction vectors of the current stage.

1       8.     A method for adaptively analyzing an observed signal, the signal characterized by  
2     discrete data, the data characterized by a vector data set and a scalar data set, the sets having a  
3     common index, to obtain a decomposition of the data based on correlation between the sets, the  
4     method comprising

5                   in a first stage:

6                   forming a first stage correlation direction vector between corresponding elements of  
7                   the vector data set and the scalar data set;

8                   forming a set of first stage inner products between the vector data set and the first  
9                   stage correlation direction vector;

10                  forming a set of first stage scaled direction vectors between the scalar data set and  
11                  the first stage correlation direction vector;

12                  forming a set of first stage vector differences between the corresponding elements of  
13                  the set of first stage scaled direction vectors and the vector data set; and

14                  in each of zero or more subsequent stages:

15                  receiving the set of inner products and the set of vector differences of the  
16                  immediately prior stage as inputs to the current stage;

17 forming a current stage correlation direction vector between corresponding elements  
18 of the sets of inner product and vector difference current stage inputs;  
19 forming a set of current stage inner products between the set of current stage vector  
20 difference inputs and the current stage correlation direction vector;  
21 forming a set of current stage scaled direction vectors between the set of inner  
22 product current stage inputs and the current stage correlation direction vector;  
23 forming a set of current stage vector differences between the corresponding elements  
24 of the set of current stage scaled direction vectors and the set of current stage  
25 vector difference inputs.

1 9. An adaptive stage of an analysis chain for a multistage adaptive filter, the adaptive stage  
2 comprising:

3 a correlation direction vector logic device:

4 in communication with the immediately prior stage, and  
5 operative:

6 to receive a set of vector differences of the immediately prior stage and a  
7 set of inner products of the immediately prior stage, and  
8 to form a current stage correlation direction vector between the vector  
9 differences of the immediately prior stage and the corresponding  
10 inner products of the immediately prior stage; and

11 an adaptive stage inner product logic device:

12 in communication with the immediately prior stage and the adaptive stage  
13 correlation direction vector logic device of the current stage, and  
14 operative:

15 to receive the set of vector differences of the immediately prior stage and  
16 the current stage correlation direction vector, and  
17 to form a current stage set of inner products of each vector difference of  
18 the immediately prior stage and the current stage correlation direction  
19 vector; and

20 an adaptive stage vector scaling logic device:

21 in communication with the correlation direction vector logic device of the  
22 current stage and the inner product device of the current stage, and  
23 operative:

24 to receive the set of inner products of the current stage and the correlation  
25 direction vector of the current stage, and  
26 to form a current stage set of scaled direction vectors of each inner product  
27 of the set of inner products of the current stage and the correlation  
28 direction vector of the current stage; and  
29 an adaptive stage vector difference logic device:  
30 in communication with the vector difference logic device of the immediately prior  
31 stage and the vector scaling logic device of the current stage, and  
32 operative:  
33 to receive the set of vector differences of the immediately prior stage and  
34 the set of scaled vectors of the current stage, and  
35 to form a current stage set of vector differences between corresponding  
36 elements of the set of vector differences of the immediately prior  
37 stage and the set of scaled direction vectors of the current stage.

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